

# IB Math HL Y1

## Logarithmic Functions and Equations

Name \_\_\_\_\_ Date \_\_\_\_\_

### Part 1 – Review

Complete the following:

#### Properties of Logarithms

- $\log_a(pq) =$
- $\log_a \frac{p}{q} =$
- $\log_a(p^q) =$

What are the restrictions on  $a$ ,  $p$ , and  $q$ ?

#### Additional Properties of Logarithms

- Converting between exponents and logs

$$\log_a x = y \Leftrightarrow$$

- Change of base

$$\frac{\log_a x}{\log_a y} =$$

- Inverse property

$$a^{\log_a x} = \log_a(a^x) =$$

1. Simplify

a)  $\log_2\left(\frac{1}{16}\right)$

b)  $\log_{27} 9$

c)  $2\log 5 + 2\log 2$

d)  $5 - 2\log_2 6$

e)  $3\log_x 2 - \log_x 12 + 2\log_x 4$

2. Solve each equation, giving the roots correct to 3 significant figures.

a)  $2^x = 17$

b)  $2\ln x = 11$

What relationship between logs and exponents did you use?

3. Given the function  $y = \log_a x$ ,  $a > 1$ :
- State the domain and range.
  - State the coordinates of the  $x$ - and/or  $y$ -intercepts.
  - State the equations of any asymptotes
  - Make a rough sketch.

**Part 2 – Review??**

4. Solve  $\log_6 (x+2) + \log_6 (x+1) = 1$ .

5. Solve the simultaneous equations  $\log_a (x+y) = 0$  and  $2\log_a x = \log_a (4y+1)$ .

6. If the graph of  $y = a \log_6 (x-p)$  passes through (9,6) and has a zero at  $x = 4$ , find the values of  $a$  and  $p$ .

7. For a radioactive isotope,  $A = A_0 e^{-kt}$ , where  $A$  is the mass of the isotope in grams,  $A_0$  is the initial mass, and  $t$  is the time in years. In 5 years, 40 g of this substance is reduced to 34 g.
- Find the value of  $k$ , correct to 3 s.f.
  - Find the half-life of this substance.

8. Solve  $(6^x)(3^{2x+1}) = 4^{x+2}$ , giving your answer in the form  $x = \frac{\ln a}{\ln b}$ , where  $a$  and  $b$  are rational numbers.

10. The Challenger disaster in 1986 was found to have been caused by the failure of multiple primary O-rings. As a result, a study was made of the 23 launches that preceded the fatal flight. A mathematical model was developed involving the relationship between the Fahrenheit temperature  $x$  around the O-rings and the number  $y$  of eroded or leaky primary O-rings. The model stated that

- a) Sketch the graph of the model.
- b) What is the predicted number of eroded or leaky primary O-rings at a temperature of
- (i)  $100^{\circ} F$  (ii)  $60^{\circ} F$  (iii)  $30^{\circ} F$
- c) At what temperature is the predicted number of eroded or leaky O-rings equal to
- (i) 1 (ii) 3 (iii) 5